HomeMaestro: Order From Chaos In Home Networks

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ABSTRACT

We present HomeMaestro, a distributed system for monitoring and instrumentation of home networks. HomeMaestro performs extensive measurements at the host level to infer application network requirements, and identifies network-related problems through time-series analysis. By sharing and correlating information across hosts in the home network, our system automatically detects and resolves contention over network resources among applications based on predefined policies. Finally, HomeMaestro implements a distributed virtual queue to enforce those policies by prioritizing applications without additional assistance from network equipment such as routers or access points.

Categories and Subject Descriptors

C.2.0 [**Computer Communication Networks**]: General; C.2.3 [**Computer Communication Networks**]: Network Operations,Network Monitoring; C.2.3 [**Computer Communication Networks**]: Network Operations,Network Management

General Terms

Measurement, Performance

1. OVERVIEW

The number and complexity of home networks continues to grow as broadband penetration increases and as more network enabled devices, such as gaming consoles, VoIP phones, media centers, and others, enter the home network. Typically, multiple family members use those devices to access the Internet, telework, consume multimedia content, play games, and socialize. All of those users and applications uncoordinatedly compete for the limited home network resources, such as the Internet broadband link and the wireless network. The result is often poor experience for the end user (eg poor video streaming, slow web surfing). Currently there is a lack of mechanisms to identify and remedy those problems.

HomeMaestro is a user-level software that performs extensive measurements at the host level and, using time-series analysis, infers application network requirements. By sharing and correlating information across other HomeMaestro-enabled hosts in the home network, our system automatically detects contention for network resources. HomeMaestro implements a distributed virtual queue to enforce those
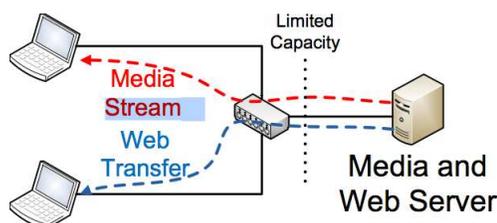
Figure 1: Schematic representation of the demonstration setup.

policies by prioritizing applications. It is important to notice that HomeMaestro detects performance problems and enforces policies in a distributed setting at the end-hosts, and does not require changes to the applications or the networking devices. More details can be found in [1].

2. DEMO DESCRIPTION

The demo comprises of a server that streams media content and serves web pages, and two workstations (see Figure 1). One workstation will be performing a long web transfer, and the other will be streaming a movie. The aggregate available bandwidth from the clients to the server is limited, and this simulates the limited resources in the access link of typical home environments. (We implement the capacity constraint by rate limiting the bandwidth of the server.) The home network is simulated by the two workstations.

Since there is not enough capacity for both the media stream and the web transfer, when there is no coordination between the workstations, the experience of the media stream is very poor (the stream pauses frequently).

When we enable our system, we will demo (a) how the workstations collect information about the competing flows, (b) how they exchange information and detect the performance problems, and (c) the actions they take to remedy the problem. After the system stabilizes, the media stream will take priority over the web transfer and as a result will not experience problems due to lack of bandwidth.

The purpose of the demo is not only to demonstrate that the coordinate can fix the problem, but also to give some extra insights into the operation of our system. This includes the time to converge, the overhead of messages, the way the algorithms adapt, and others.

3. REFERENCES

[1] T. Karagiannis, E. Athanasopoulos, C. Gkantsidis, and P. Key. Homemaestro: Order from chaos in home networks. Technical report, Microsoft Research, MSR-TR-2008-84, 2008.